

AMENDMENTS TO THE CLAIMS:

If entered, this listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently Amended) A method for forming a metal bump on a semiconductor substrate, comprising the steps of:

providing a semiconductor substrate, said semiconductor substrate having been provided in or on the surface thereof with a contact pad, said contact pad sitting on an underlying layer of dielectric and being in electrical contact with at least one point of electrical contact in or on the surface of said substrate;

depositing a layer of passivation over the surface of said layer of dielectric underlying the contact pad, including the surface of said contact pad ~~wherein said layer of passivation is not photoresist;~~

patterning and etching said layer of passivation, creating an opening in said layer of passivation having a first diameter, partially exposing the surface of said contact pad over a surface area of said first diameter,

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said first diameter of said opening created in said layer of passivation being smaller than a surface area of said contact pad by an amount;

20       etching said contact pad, using said layer of passivation as a mask, partially or completely first removing said contact pad from above the surface of said layer of dielectric, creating a opening in said contact pad having a diameter being about equal to said first diameter;

25       sputtering a layer of Under Bump Metallurgy (UBM) over the surface of said layer of passivation, including said opening created in said contact pad;

      depositing and patterning a layer of photoresist, creating an opening in the photoresist with a slightly  
30   larger dimension than said first diameter;

      electroplating a layer of bump metal in the photoresist opening; stripping the layer of photoresist and etching said layer of UBM, using said layer of bump metal as a mask; and reflowing the surface of said layer of bump  
35   metal, forming the metal bump.

2. (Previously Presented) The method of claim 1 wherein said opening created in said contact pad has a depth that is less than a height of said contact pad by an amount.

3. (Original) The method of claim 1 wherein said opening created in said contact pad has a depth that is equal to a height of said contact pad.

4. (Original) The method of claim 1 wherein said contact pad comprises aluminum or copper or a compound thereof.

5. (Original) The method of claim 1 further comprising the additional step of electroplating an enhanced UBM layer, after creating said opening in said layer of photoresist, and prior to electroplating said layer of bump metal.

6. (Original) The method of claim 1 wherein said contact pad is accessed by means of interconnect metal being provided in a plane of said contact pad and overlying said layer of dielectric.

7. (Original) The method of claim 1 wherein said contact pad is accessed by means of at least one via provided through said layer of dielectric.

8. (Currently Amended) A method for forming a metal bump on a semiconductor substrate, comprising the steps of:

providing a semiconductor substrate, said  
semiconductor substrate having been provided in or on the  
5 surface thereof with a contact pad, said contact pad  
sitting on an underlying layer of dielectric;

depositing a layer of passivation over the surface of  
said layer of dielectric, including the surface of said  
contact pad ~~wherein said layer of passivation is not~~  
10 ~~photoresist~~;

patterning and etching said layer of passivation,  
creating an opening in said layer of passivation having a  
first diameter, partially exposing the surface of said  
contact pad over a surface area of said first diameter,  
15 said first diameter of said opening created in said layer  
of passivation being smaller than a surface area of said  
contact pad by an amount;

depositing a layer of polyimide over the surface of  
said layer of passivation, including the opening created in  
20 said layer of passivation;

patterning and etching said layer of polyimide,  
creating an opening in said layer of polyimide having a  
second diameter, partially exposing the surface of said  
contact pad over a surface area of said second diameter,

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25    said second diameter of said opening created in said layer  
of polyimide being smaller than said first diameter by an  
amount;

etching said contact pad, using said layer of  
polyimide as a mask, partially or completely removing said  
30    contact pad from above the surface of said layer of  
dielectric, creating an opening in said contact pad having a  
diameter being about equal to said second diameter;

sputtering a layer of Under Bump Metallurgy (UBM) over  
the surface of said layer of polyimide, including said  
35    opening created in said contact pad;

depositing and patterning a layer of photoresist,  
creating an opening in said layer of photoresist with a  
slightly larger dimension than said second diameter;  
electroplating a layer of bump metal in the opening created  
40    in said layer of photoresist;

stripping said layer of photoresist;

etching said layer of UBM, using said layer of bump  
metal as a mask; and

reflowing the surface of said layer of bump metal,  
45    forming the metal bump.

9. (Previously Presented) The method of claim 8 wherein said opening created in said contact pad has a depth that is less than a height of said contact pad by an amount.

10. (Original) The method of claim 8 wherein said opening created in said contact pad has a depth that is equal to a height of said contact pad.

11. (Original) The method of claim 8 wherein said contact pad comprises aluminum or copper or a compound thereof.

12. (Original) The method of claim 8 further comprising the additional step of electroplating an enhanced UBM layer, after creating said opening in said layer of photoresist, and prior to electroplating said layer of bump metal.

13. (Original) The method of claim 8 wherein said contact pad is accessed by means of interconnect metal being provided in a plane of said contact pad and overlying said layer of dielectric.

14. (Original) The method of claim 8 wherein said contact pad is accessed by means of at least one via provided

through said layer of dielectric down to the surface of  
said semiconductor surface.

15. (Currently Amended) A method for forming a metal bump  
on a semiconductor substrate, comprising the steps of:

providing a semiconductor substrate, said  
semiconductor substrate having been provided on the surface  
5 thereof with a contact pad, said contact pad overlying a  
layer of dielectric, said layer of dielectric having been  
deposited over said semiconductor substrate; and

partially removing said contact pad in accordance with  
a mask of passivation material, said removing having a  
10 removal thickness and removal surface area wherein said  
mask is not removed during further processing. ~~wherein said~~  
~~mask of passivation is not photoresist.~~

16. (Previously Presented) The method of claim 15 wherein  
said removal surface area of said contact pad is smaller  
than a surface area of said contact pad by an amount.

17. (Previously Presented) The method of claim 15 wherein  
said removal thickness of said contact pad is less than a  
height of said contact pad by an amount.

18. (Original) The method of claim 15 wherein said removal thickness of said contact pad equals a height of said contact pad.

19. (Previously Presented) The method of claim 15 wherein said partially removing said contact pad in accordance with a mask of passivation material comprises the steps of:

depositing a layer of passivation material over the  
5 surface of said layer of dielectric, including the surface of said contact pad;

patterning and etching said layer of passivation material, creating an opening in said layer of passivation material having a first diameter, partially exposing the  
10 surface of said contact pad over a surface area of said first diameter, said first diameter of said opening created in said layer of passivation material being smaller than a surface area of said contact pad by an amount; and

etching said contact pad, using said patterned layer  
15 of passivation material as a mask, creating an opening in said contact pad having a second diameter, partially or completely first removing said contact pad from above the surface of said layer of dielectric, said second diameter of said first opening created in said contact pad being



20 about equal to said first diameter of said opening created  
in said layer of passivation material.

20. (Previously Presented) The method of claim 19 with  
additional steps of:

sputtering a layer of Under Bump Metallurgy (UBM) over  
the surface of said layer of passivation, including said  
5 first opening created in said contact pad, leaving in place  
a layer of said UBM overlying said contact pad;

depositing and patterning a layer of photoresist,  
creating an opening in said layer of photoresist with a  
slightly larger diameter than said first diameter;  
10 electroplating a layer of bump metal in said opening  
created in said layer of photoresist;

stripping the layer of photoresist and blanket etching  
said layer of UBM; and

reflowing the surface of said layer of bump metal,  
15 forming the metal bump.

21. (Original) The method of claim 20 wherein said layer of  
Under Bump Metallurgy comprises a plurality of sub-layers  
of different metallic composition.

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22. (Original) The method of claim 15 wherein said contact pad comprises aluminum or copper or a compound thereof.

23. (Original) The method of claim 20 with the additional step of electroplating an enhanced layer of UBM, after creating the opening in said layer of photoresist, and prior to the electroplating of said layer of bump metal.

24. Canceled

25. Canceled

26. (Original) The method of claim 15 wherein said contact pad is accessed by means of interconnect metal being provided in a plane of said contact pad and overlying said layer of dielectric.

27. (Original) The method of claim 15 wherein said contact pad is accessed by means of at least one via provided through said layer of dielectric.

28. Canceled

29. Canceled

30. Canceled

31. Canceled

32. (Previously Presented) The method of claim 15 wherein said partially removing said contact pad comprises the steps of:

depositing a layer of passivation over the surface of  
5 said layer of dielectric, including the surface of said contact pad;

patterning and etching said layer of passivation,  
creating an opening in said layer of passivation having a first diameter, partially exposing the surface of said  
10 contact pad over a surface area of said first diameter, said first diameter of said opening created in said layer of passivation being smaller than a surface area of said contact pad by an amount;

depositing a layer of polyimide over the surface of  
15 said layer of passivation, including the opening created in said layer of passivation;

patterning and etching said layer of polyimide,  
creating an opening in said layer of polyimide having a  
second diameter, partially exposing the surface of said  
20 contact pad over a surface area of said second diameter,  
said second diameter of said opening created in said layer  
of polyimide being smaller than said first diameter by an  
amount; and

etching said contact pad, using said layer of  
25 polyimide as a mask, partially or completely removing said  
contact pad from above the surface of said layer of  
dielectric, creating an opening in said contact pad having  
a diameter being about equal to said second diameter.

33. (Original) The method of claim 32 with additional steps  
of:

sputtering a layer of Under Bump Metallurgy (UBM) over  
the surface of said layer of polyimide, including said  
5 opening created in said contact pad;

depositing and patterning a layer of photoresist,  
creating an opening in said layer of photoresist with a  
slightly larger dimension than said second diameter;

electroplating a layer of bump metal in the opening  
10 created in said layer of photoresist;

stripping said layer of photoresist;

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etching said layer of UBM, using said layer of bump  
metal as a mask; and

reflowing the surface of said layer of bump metal,1  
15 forming the metal bump.

34. Canceled

35. Canceled

36. (Original) The method of claim 33 with the additional  
steps of electroplating an enhanced layer of UBM, after  
creating the opening in said second layer of photoresist,  
and prior to the electroplating of said layer of bump  
5 metal.

37 - 40. (Canceled)